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Effects of ions on gap closure in crossed-field Diodes Y.Y. LAU, University of Michigan, J.W. LUGINSLAND, NumerEx, K.C. CARTWRIGHT, M.D. HAWORTH, Air Force Research Lab — The presence of plasmas has long been suspected to be a major cause of gap closure in a high power diode whose electrons are presumably magnetically insulated. In this paper, we report an in-depth study of the effects of ions on magnetic insulation of electrons. We find that, in general, the presence of ions in a crossed-field gap always increases the electrons' excursions toward the anode, regardless of the location of the ions. This effect is much more pronounced with ions situated in the cathode region than ions in the anode region. These properties are shared by single particle orbit models, shear flow models, and particle-in-cell simulations. Thus, the rate at which the electrons migrate toward the anode is related to the rate at which ions are introduced into the crossed-field gap. We should point out that this anode-migration of electrons is unrelated to crossed-field ambipolar diffusion. The implications of these findings are explored, such as pulse shortening in relativistic magnetrons [1] and bipolar flows in pulsed-power systems. [1] Luginsland et al., in this conference.

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